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(54) BODY FOR A ROAD OR RAIL VEHICLE OR FOR A CONTAINER

(71) We, PIKAZ-INZENYRSKY PODNIK, a Czechoslovakian Body Corporate, of No. 49 Oldrichova, Prague 2, Czechoslovakia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a body for a road or rail vehicle or for a container.

It is known for such bodies to be made either from conventional materials joined to an insulation filling by a supporting structure, or from sheathing materials consisting of synthetic substances applied to a supporting structure, the fillings being made of an insulating compound or of sandwich materials having an internal filling of the insulating compound, which have likewise been applied to this structure. In all of these cases a self-supporting body is formed and after attachment to a chassis forms a conveying space of a road or rail vehicle. The construction of such prior art bodies involves high labour and investment costs.

According to one aspect of this invention there is provided a body for a road or rail vehicle or for a container, the body comprising an inner tube formed of a plurality of layers of synthetic resin impregnated material and reinforced by means of circumferential protrusions; thermal insulation material arranged on the outside of the inner tube and providing reinforcement for an outer tube of the body, with or without the assistance of reinforcing elements; and an outer tube formed of a plurality of layers of synthetic resin impregnated material wound on the thermal insulation material (and reinforcing elements, if present); said tubes and thermal insulation material (and reinforcing elements if present) being securely interconnected.

The impregnated material may comprise filaments and/or fabric, and for convenience in manufacture the same impregnated material may be used throughout the body.

Any reinforcing elements assisting the thermal insulation material may be in the form of for example beams, section elements (i.e. elongate elements of uniform cross-section), prisms, grids or honeycombs.

The thermal insulation material may be either a foamed synthetic substance, for example a rigid light material (polyurethane) or polyvinyl chloride or polystyrene. However, preferably the thermal insulation material is rigid and provides reinforcement for the outer tube of the body without the need for any assisting reinforcing elements.

Where the protrusions, i.e. reinforcing ribs, are on the inner tube, these ribs can be formed on the inner tube by a connection by means of a laminate and/or by the winding technique. A number of such bodies may be arranged consecutively to form a body unit. This is readily accomplished if these bodies are provided with frame reinforcement which likewise facilitates attachment of an end wall and a door wall. If such a body is provided from below with a supporting structure or with a frame, which is joined to the body be envelopment with a filament and/or fabric which are impregnated with a synthetic resin, then this represents a very rigid self-supporting structural element.

According to another aspect of this invention there is provided a method of making a body for a road or rail vehicle or for a container, comprising the steps of winding a plurality of layers of a synthetic resin impregnated material onto a former to produce an inner tube and forming reinforcing circumferential protrusions; applying thermal insulation material with or without reinforcing elements to the plurality of layers while they are in a partly hardened state,

which material together with the reinforcing elements, if present, provides reinforcement for an outer tube of the body; and winding a plurality of layers of a synthetic resin impregnated material therearound to form an outer tube, said tubes and thermal insulation material (and reinforcing elements, if present) becoming securely interconnected upon hardening of the synthetic resin.

According to a further aspect of this invention there is provided a method of making a body for a road or rail vehicle or for a container, comprising the steps of winding a plurality of layers of a synthetic resin impregnated material onto a former to produce an inner tube and forming reinforcing circumferential protrusions; applying reinforcing elements to a part of the outside of the inner tube; applying a plurality of layers of synthetic resin impregnated material to form an outer tube connected to the inner tube by said reinforcing elements, which reinforcing elements are so arranged as to provide a cavity between the tubes; and then introducing into said cavity between the tubes a foamed insulation material which upon hardening securely interconnects the tubes and the reinforcing material.

Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 shows a wound laminate tubular body;

Figure 2 shows details of several arrangements of reinforcements usable in making a wound laminate tubular body;

Figure 3 shows an inner tube of wound laminate together with reinforcements, thermal insulation panels, and services facilities, for example electricity, water, ventilation and heating;

Figure 4 shows a demountable winding former for a plain inner tube; and

Figure 5 shows a modified form of the demountable winding former for making an inner tube having stiffening ribs.

In Figure 1 there is shown a body comprising an outer tube 1 formed of wound laminate (i.e. a plurality of layers of synthetic resin impregnated material) and an inner tube 2 also formed of wound laminate and having its floor part reinforced with steel U-channel beams 3 extending along the length of the inner tube and being connected by transverse strips welded to the beams 3.

In Figure 2 there is shown a body having a plurality of reinforcements in the form of U-channel elements extending around the body in respective planes at right angles to the longitudinal axis of the body and having their flat bottoms connected to the outer surface of the inner tube. The section taken at A shows the use of a pair of the U-channel elements arranged in side-to-side abutting relationship, the layers of the outer tube being wound over the pair of elements. The section taken at B shows a reinforcement comprising only a single U-channel element.

The section shown at A^1 in Figure 2 is a detail of the connection of two bodies of a body unit. Each body has a U-channel element connected to the extreme end of its inner tube, and the respective outer tubes are wound only up to the inner flange of the U-channel element. In this way the outer flanges are accessible for interconnection by for example bolting together.

The body shown in Figure 3 has its outer tube omitted in order to illustrate the fitting of preformed panels of thermal insulation material to the outer surface of the inner tube. Shaped panels 4 are used over the longitudinal edges of the body, and flat panels 5 are used over the flat regions of the inner tube. Provision is made at 6 for the electrical wiring of the body, and ventilation may also be provided; heating means is provided at 7; and pipes for distribution of water are provided at 8.

Figure 4 shows a demountable former used in making plain inner tubes, i.e. those not having stiffening profiling, i.e. protrusions in the inner tube. The former comprises upper and lower portions, and, for removing the former from the inner tube, means comprising a distance tube 11, nut 12 threaded onto a bar 13, and a pair of longitudinally extending wedges 14 all disposed in the parting plane of the former.

Figure 5 shows the former of Figure 4 but including a plurality of circumferential grooves or recesses 15 extending around the former in respective planes at right angles to its longitudinal axis. The layers of an inner tube are pressed into the grooves in order to provide stiffening profiling in the form of protrusions or ribs when the material has hardened.

In the manufacture of a body, firstly, a filament and/or fabric impregnated with synthetic resin is wound in several layers, preferably in criss-cross fashion and more preferably with the winding direction being changed by a right angle for each successive layer, onto a former whereby there is produced an inner tube having, e.g., a generally uniform rectangular or curved cross-sectional configuration as required. If the former is provided with recesses, as shown in Figure 5, then it is possible to shape the freshly wound material of the inner tube by compression, whereby the inner tube conforms to the shape of the recessed former which results in a reinforcement of the entire body. Preferably the recesses are in the form of elongate grooves, whereby the inner tubes become formed with ribs.

A similar reinforcing effect is achieved if reinforcing elements are inserted in the recesses of the former, which elements are adjoined to the subsequently wound inner tube by lining with layered material (laminate), or the ribs are formed by initially winding a fibrous material impregnated with synthetic resin into the recesses prior to winding the layers of the inner tube. A further method of reinforcing the inner tube is to form the tube with recesses by the abovementioned compression step, then place reinforcing elements into the corresponding recesses thus formed in the outer surface of the inner tube and join these elements to the tube by synthetic resin impregnated material. There is then applied to the inner tube while it is partially hardened shaped parts of rigid foam insulation material, and supports or frames for apertures. The rigid insulation material provides reinforcement for the outer tube which is now formed by enveloping the insulation material, again in criss-cross fashion, several times with a filament and/or a fabric impregnated with synthetic resin, whereby an outer tube results, and by hardening the synthetic resin all of these parts thus become interconnected. However, where a thermal insulation material is used which is not suitable by itself, then it will be assisted by the addition of reinforcing elements.

In an alternative method of making a body a reinforcement is applied to a part of the outside of an inner tube, and an outer tube is then wound around the inner tube and reinforcement. The reinforcement is so arranged as to provide a cavity between the inner and outer tubes, and this cavity is then filled up with a quantity of foam material, which after foaming and hardening securely joins all of these parts of the body.

These bodies are preferably provided at their ends with a reinforcement (as shown in detail A^1 in Figure 2) to facilitate the attachment of an end wall and a door wall, respectively, or if required the interconnection of a number of bodies to form a body unit. Preferably a body, or a body unit, (as can be seen in Figure 2) may be mounted on a supporting structure to which it is connected by means of an enveloping material impregnated with synthetic resin, whereby once more the rigidity of the body (or body unit) is increased.

If an aperture, for example a window, is required then a frame can be applied to the inner tube of the body, and the aperture formed by cutting out, either before or after hardening of the completed body, as desired, the parts of the tubes corresponding to the aperture bounded by the frame.

The aforedescribed bodies are rigid, easy to manufacture and have a high degree of strength. They are suitable for transportation containers, in particular for cooled products, and may also be utilised in the production of road and rail vehicles. It will be seen that these bodies provide a vapour barrier, and, provided that any reinforcing elements assisting the thermal insulation material are themselves thermal insulators, have substantially no thermal bridges between the inner tube and the outer tube. As will be seen from the aforedescribed methods the manufacture of the bodies can be accomplished in one working operation, so capital investment need not be high. It is thus possible to obtain savings in production manpower, important savings in metals and thus savings in overall cost and weight. Thus it will be appreciated that such bodies and methods of making them can be employed advantageously in the field of transportation.

WHAT WE CLAIM IS:—

1. A body for a road or rail vehicle or for a container, the body comprising an inner tube formed of a plurality of layers of synthetic resin impregnated material and reinforced by means of circumferential protrusions; thermal insulation material arranged on the outside of the inner tube and providing reinforcement for an outer tube of the body, with or without the assistance of reinforcing elements; and an outer tube formed of a plurality of layers of synthetic resin impregnated material wound on the thermal insulation material (and reinforcing elements, if present); said tubes and thermal insulation material (and reinforcing elements, if present) being securely interconnected.

2. A body as claimed in claim 1 wherein said synthetic resin impregnated material comprises filaments and/or fabric.

3. A body as claimed in either claim 1 or claim 2 wherein the synthetic resin impregnated material of the inner tube is the same as the synthetic resin impregnated material of the outer tube.

4. A body as claimed in any of claims 1 to 3 and either including, or wherein said reinforcing elements include, as the case may be, a frame reinforcement at each end of the body.

5. A body as claimed in any one of claims 1 to 4 and including a supporting structure connected to the outer tube by means of synthetic resin impregnated material.

6. A body as claimed in any one of claims 1 to 5 wherein portions of the body forming side walls thereof include apertures bounded by frames.

7. A body as claimed in any one of claims 1 to 6 wherein the protrusions are

in the form of ribs of synthetic resin impregnated material with or without the inclusion of reinforcing elements and connected to the inner tube.

8. A body as claimed in any one of claims 1 to 6 wherein the protrusions are in the form of a deformation of the inner tube and have associated corresponding recesses.

9. A body as claimed in claim 8 wherein there are provided reinforcing elements in the recesses, being securely connected thereto by synthetic resin impregnated material.

10. A body as claimed in any one of claims 1 to 9 wherein reinforcing elements assisting said thermal insulation material are present and are formed of thermally insulative material.

11. A body for a road or rail vehicle or for a container substantially as hereinbefore described with reference to any one of Figures 1 to 3 of the accompanying drawings.

12. A method of making a body for a road or rail vehicle or for a container, comprising the steps of winding a plurality of layers of a synthetic resin impregnated material onto a former to produce an inner tube and forming reinforcing circumferential protrusions; applying thermal insulation material with or without reinforcing elements to the plurality of layers while they are in a partly hardened state, which material together with the reinforcing elements, if present, provides reinforcement for an outer tube of the body; and winding a plurality of layers of a synthetic resin impregnated material therearound to form an outer tube, said tubes and thermal insulation material (and reinforcing elements, if present) becoming securely interconnected upon hardening of the synthetic resin.

13. A method of making a body for a road or rail vehicle or for a container comprising the steps of winding a plurality of layers of a synthetic resin impregnated material onto a former to produce an inner tube and forming reinforcing circumferential protrusions; applying reinforcing elements to a part of the outside of the inner tube; applying a plurality of layers of synthetic resin impregnated material to form an outer tube connected to the inner tube by said reinforcing elements, which reinforcing elements are so arranged as to provide a cavity between the tubes; and then introducing into said cavity between the tubes a foamed insulation material which upon hardening securely interconnects the tubes and the reinforcing elements.

14. A method as claimed in either claim 12 or claim 13 wherein the former is provided with recesses for forming the protrusions.

15. A method as claimed in claim 14 and including the step of pressing said layers forming the inner tube into the recesses such that the inner tube becomes formed with corresponding recesses on its outer surface.

16. A method as claimed in claim 15 and including the further steps of inserting other reinforcing elements into the recesses of the inner tube and winding further layers of the synthetic resin impregnated material around the inner tube to connect securely said other reinforcing elements to the inner tube.

17. A method as claimed in claim 14 and including the prior step of introducing into the recesses other reinforcing elements and/or layers of synthetic resin impregnated material, and then effecting the step of winding said layers of the inner tube.

18. A method as claimed in any one of claims 12 to 17 wherein reinforcing elements assisting said thermal insulation material are present and are formed of thermally insulative material.

19. A method as claimed in any one of claims 12 to 18 including the intermediate step of applying to the inner tube a frame defining an aperture for the body; and the step of cutting out material to form the aperture in the body after forming the outer tube.

20. A method as claimed in any one of claims 12 to 19 including the step of forming or providing a frame reinforcement at each end of the body.

21. A method as claimed in claim 20 and including the step of fastening an end wall and a door wall to the respective ends of the body by means of a mechanical connection and/or by means of synthetic resin impregnated material.

22. A method as claimed in any one of claims 12 to 21 wherein neighbouring layers are wound with differing winding directions.

23. A method of making a body for a road or rail vehicle or for a container, substantially as hereinbefore described with reference to the accompanying drawings.

24. A body when made by a method as claimed in any one of claims 12 to 23.

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5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

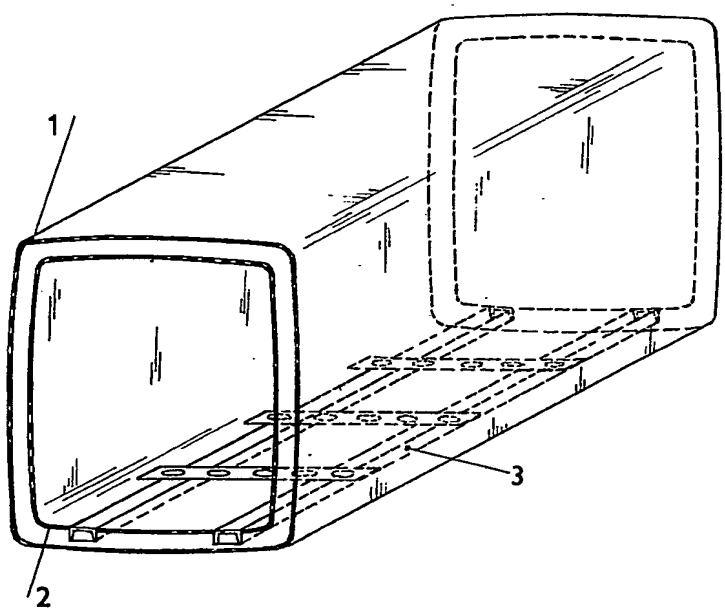
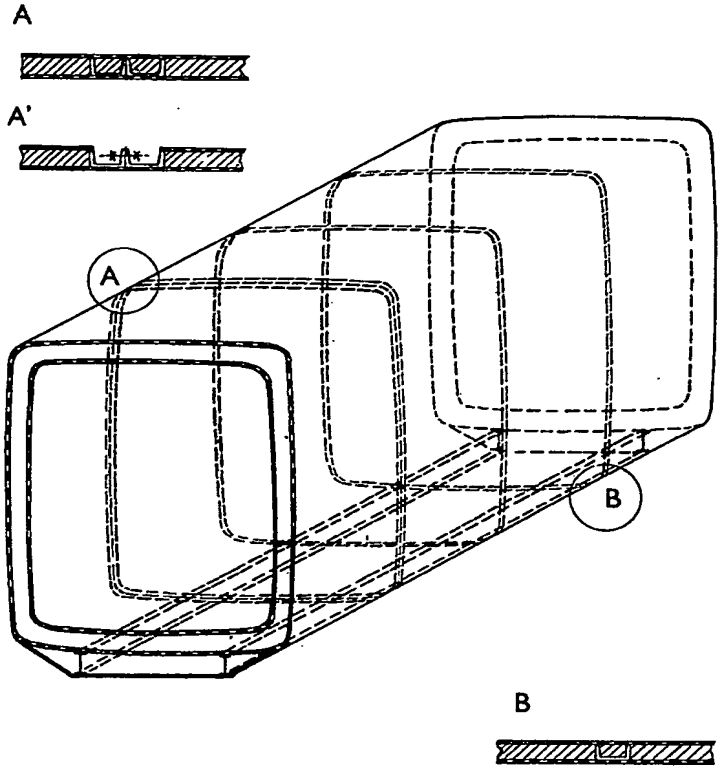


FIG. 2



1490575 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

FIG. 3

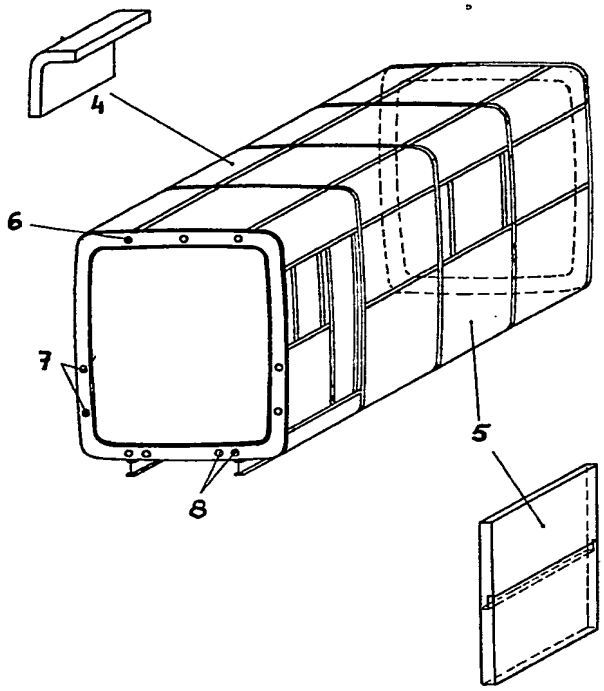


FIG. 4

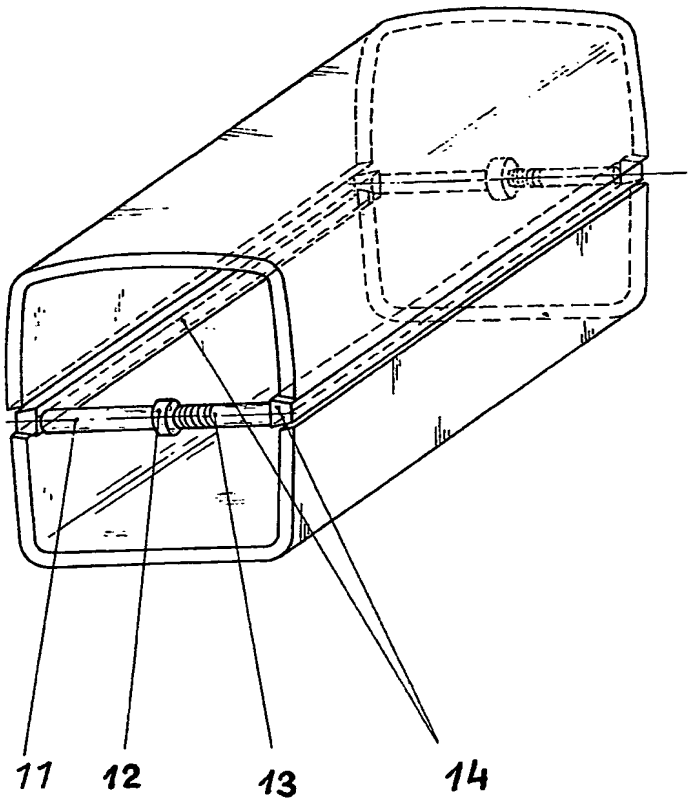


FIG. 5